STANDALONE UNIT OF A STANDALONE POWER GRID FOR COMMUNICATING ENERGY REQUESTS WITH ANOTHER STANDALONE UNIT

[0001] The invention relates to a standalone unit for a standalone power grid, to a standalone power grid comprising a standalone unit and to a method for controlling a standalone power grid.

[0002] Standalone units, for example ones that supply electrical power to a household, as consumer unit, are well known. Such a standalone unit has a power generation unit, such as a photovoltaic system, which generates energy from renewable resources, such as solar insolation, and which supplies that energy to the household. When the photovoltaic system generates a substantial amount of energy, for example when weather conditions are good, the household is supplied with sufficient electrical power. When the photovoltaic system generates less energy than the household consumes, for example at night or when weather conditions are poor, the household needs to cover its energy requirements from a public or external power grid. For this purpose, the standalone unit has a grid unit by means of which the standalone unit may be connected to the power grid in order to draw this energy. This connection also permits the standalone unit to release energy that it generates to the power grid when the photovoltaic system generates more energy than is consumed by the household.

[0003] The disadvantage of such a standalone unit is that it is complicated to exchange energy between the standalone unit and the power grid. More specifically, each flow of energy between the standalone unit and the power grid must be accounted for, which involves complicated calculation methods, inter alia.

[0004] A distributed energy storage system is known from US 2004/0263116 A1. Said energy storage system comprises electrical loads connected to an energy storage unit via the public power grid and energy generators that are likewise connected to the public power grid via a storage unit. The disadvantage of this system is that the public power grid must always be used in order to transfer energy from the energy generators to the electrical loads. The consequence is that, at peak times for power generation or power consumption, especially towards the end of such peak times, when the energy storage units near the electrical loads are depleted or the energy storage units near the energy generators are full, grid overload may occur, or the public grid needs to be dimensioned to match such peak loads. This results in instabilities in the public grid and unfavorable dimensioning requirements for the public grid. One object of the present invention is to overcome these disadvantages.

[0005] A local area grid for distributed power generation by means of fuel cells is known from US 2002/0036430 A1. Said system addresses the problems of coupling heat generation and electric power generation in fuel cells, and the associated overproduction of electrical energy in local households that have a fuel cell unit for power supply. The document proposes interconnecting a plurality of households by means of a grid and local power control logic in order to permit the transfer of electrical energy into the power grid from any household that is producing a surplus of energy. US 2002/0036430 A1 thus addresses a specific problem in the field of fuel cell technology and proposes a solution to that problem. The disadvantage of this solution is that, although it can be applied appropriately and economically in a specific manner to the case of overproduction of electrical energy for a standalone household, the disadvantages associated with fuel cells arise in the known manner, especially when the household requires no heat generation or only a little, and either the surplus heat produced in the course of electric power generation must be dissipated without being used, or fuel cell operation must be cut back partially or totally and electrical energy drawn from the grid. This, too, has the consequence that, with the proposed system, substantial peak loads, especially peak loads due to seasonal factors or the time of day, must be compensated by power transfer from the public grid, thus resulting in the grid instability and grid dimensioning disadvantages described above.

[0006] Finally, in the article entitled "An Architecture for Local Energy Generation, Distribution and Sharing", MIKE et al. IEEE Energy 2030, Atlanta, Ga., USA, 17-18 Nov. 2008, a power grid system is proposed that provides an intelligent power switch that is locally integrated between an energy generator, an energy storage unit and a load. The intelligent power switch is connected to a power grid via a power and communication interface. Although the disclosed system theoretically makes it possible to connect individual energy generators intelligently to local energy consumers and energy storage units, one problem that arises here is that the individual units thus defined are limited in their consumption, generation and storage capacities and that a grid designed for high transmission capacities is necessary to provide reliable power supply when uniform conditions persist for a long time. Compared to this prior art system, the object of the present invention is to provide greater stability in a power supply system while at the same time allowing advantageous dimensioning of the power supply grid.

[0007] According to the invention, this object is achieved by means of a standalone unit for a standalone grid system comprising a power generation unit, in particular a photovoltaic unit, for generating power from renewable resources, an energy storage unit for storing energy, a load connection unit for connecting the standalone unit to a consumer unit for consumption of energy, a grid unit, in particular an inverter unit, for connecting the standalone unit to a power grid, for drawing energy from the power grid and for feeding energy into the power grid, and an interface unit for communicating an energy withdrawal request and/or an energy storage request with a second standalone unit.

[0008] A power generation unit is understood in this context to be a power generation unit that is dependent on external environmental influences, in other words one whose energy yield cannot be controlled directly, but can at best be choked, like a photovoltaic system, for example, whose energy yield is directly related to the amount of incident sunlight. Other power generation units, such as fuel-fired generators, fuel cells or other power station technologies, are not affected by the problems addressed by the invention. The invention is based on the concept of a standalone power grid, which has a plurality of standalone units, communicating the energy requirement and/or energy surplus between the standalone units and being able to arrange an appropriate energy flow so that recourse to the (public) power grid can be avoided. One advantage of the inventive interface unit of a standalone unit according to the invention is that these requests to store and/or draw energy are exchanged between the neighboring installations known to the standalone unit,